Principle and Pre-Calculus Math 11	Unit
1.5 Lab - Geometric Series Lab	8
By the end of this lesson I will be able to: • Identify infinite geometric series • Convergent vs. Divergent	

ANSWER KEY

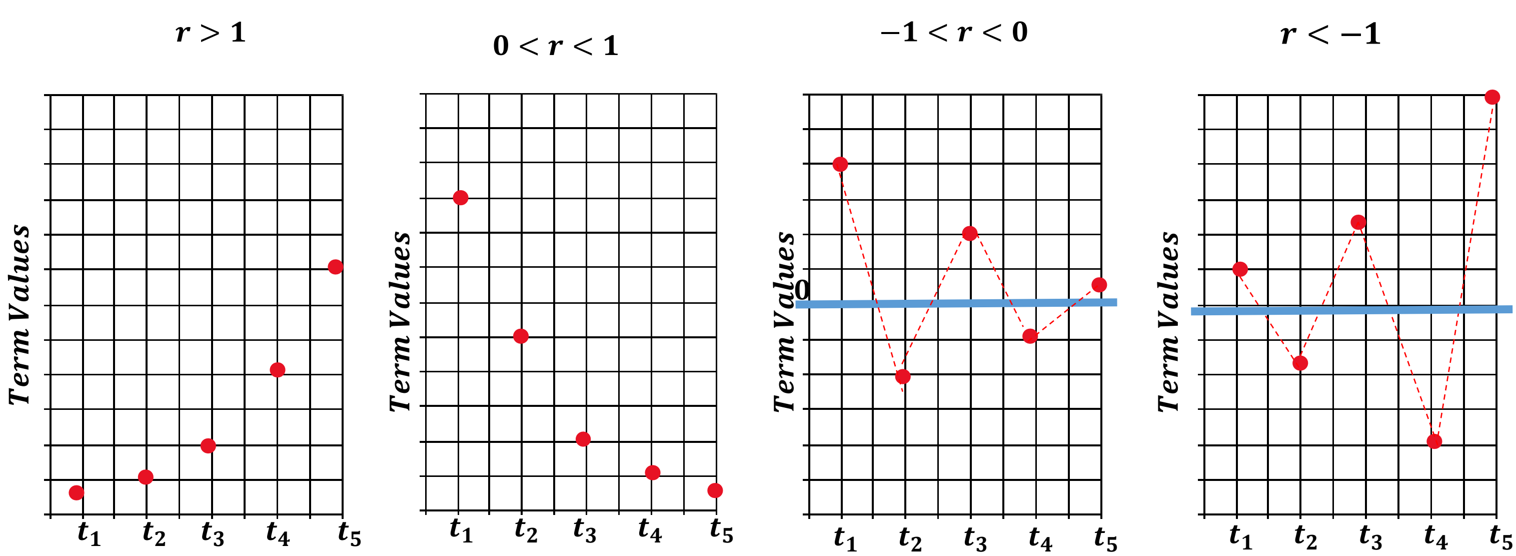
Part A: Geometric Sequences

1) Choose a positive first term. Choose a common ratio, r, in each of the intervals in the table below. For each common ratio, create the first 5 terms of a geometric sequence.

Assume: $t_1 = 10$

Interval	Common ratio, r	Geometric Sequence
$r > 1$	Example: $r = 2$	$10, 20, 40, 80, 160$ ....
$0 < r < 1$	$r = \frac{1}{2}$	$10, 5, 2.5, 1.25, 0.625$ ...
$-1 < r < 0$	$r = -\frac{1}{2}$	$10, -5, 2.5, -1.25, 0.625$ ...
$r < -1$	$r = -2$	$10, -20, 40, -80, 160$ ...

b) For each SEQUENCE:
Graph the terms numbers on the horizontal axis and the terms values on the vertical axis. Sketch and label each graph on a grid below.



c) What happens to the term values as more points are plotted for these *sequences*?

As more points are plotted:

$r > 1$	**They move further from the x-axis; Further away from zero.** (Up to the right - increasing)
$0 < r < 1$	**They move closer to the x-axis; Closer to zero.** (Down and to the right - decreasing)
$-1 < r < 0$	**Each point moves closer to the x-axis, although alternating sides** (Alternating – closer to zero)
$r < -1$	**Each point moves further from the x-axis, alternating above and below** (Alternating – further from zero)

Part B: Geometric Series

2) **Use the four geometric sequences in Part A to create four corresponding geometric series.**

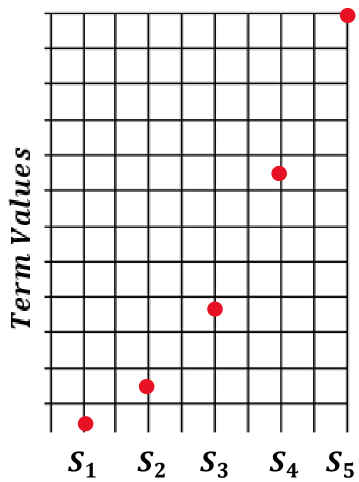
a) For each series, complete the table below by calculating these partial sums:

Using $t_1 = 10$, calculate: S_1, S_2, S_3, S_4, S_5

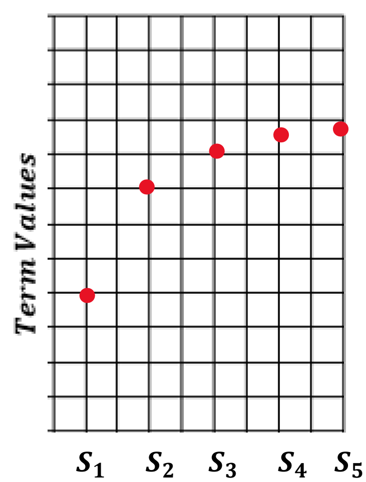
Interval	**Common ratio, r**	S_1	S_2	S_3	S_4	S_5
$r > 1$	$r = 2$	**10**	**30**	**70**	**150**	**310**
$0 < r < 1$	$r = \frac{1}{2}$	**10**	**15**	**17.5**	**18.75**	**19.375**
$-1 < r < 0$	$r = -\frac{1}{2}$	**10**	**5**	**7.5**	**6.25**	**6.875**
$r < -1$	$r = -2$	**10**	**-10**	**30**	**-50**	**110**

b) Graph the numbers of terms in the partial sums on the horizontal axis and the partial sums on the vertical axis. Sketch and label each graph on a grid below.

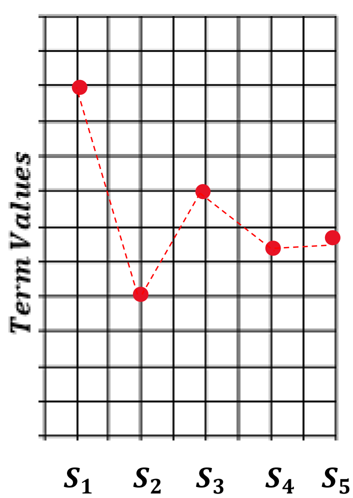
$r > 1$



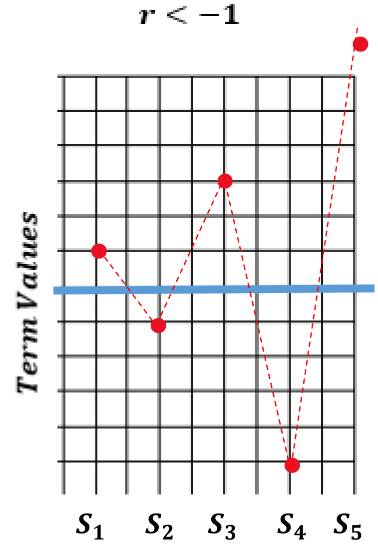
$0 < r < 1$



$-1 < r < 0$



$r < -1$



c) **What happens to the term values as more points are plotted for these <u>series</u>?**

As more points are plotted:

$r > 1$	**They move further from the x-axis; Further away from zero.** (Up to the right - increasing) **<u>Divergent</u>**
$0 < r < 1$	**They move closer to a single point (Closer towards $x = 20$)** **<u>Convergent</u>**
$-1 < r < 0$	**They move closer to a single point (Closer towards $x = 6.67$)** **<u>Convergent</u>**
$r < -1$	**They move further from the x-axis; Further away from zero.** (Alternating around x-axis - increasing) **<u>Divergent</u>**

New Definitions:

Convergent Series - If the sequence of the partial sums converges to a constant value as the number of terms increases, then the geometric series is convergent.

- **The partial sums (S_n) keep getting closer to a constant value so it is called a convergent series.**

Divergent Series - If the sequence of the partial sums does not converge to a constant value as the number of terms increases, then the geometric series is divergent.

- **The partial sums (S_n) keep getting farther away from a constant value and closer ∞ or $-\infty$ so it is called a divergent series.**